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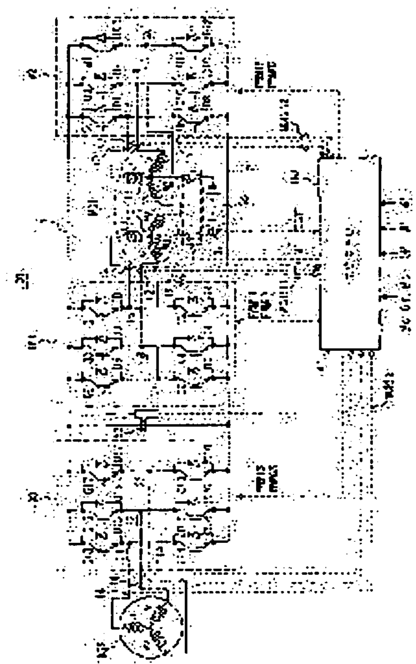
(54) POWER OUTPUT DEVICE, MOTOR DRIVING METHOD, AND RECORDING MEDIUM OF PROGRAM FOR MAKING COMPUTER PERFORM MOTOR DRIVE CONTROL AND READABLE BY COMPUTER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a power output device suited to a mechanically distributed type hybrid vehicle.
SOLUTION: This power output device 100 comprises motor generators MG1, MG2, a DC power supply 30, a relay 40, inverters 181 to 183 and a control CPU 184. The motor generator MG1 includes three-phase coils 10, 11. The DC power supply 30 is connected between neutral points M1, M2 of the three-phase coils 10, 11 through a relay 40. The control CPU184 generates an L-level signal SE for turning off the relay 40, and outputs it to the relay 40 when a sum Pm+Pg of a power Pg of the motor generator MG1 and a power Pm of the motor generator MG2 is zero, generates signals PWMC1, 2 and a PWMI3 for driving the motor generator MG2 by the electric power generated by the motor generator MG1, and outputs them to the inverters 181 to 183.



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CLAIMS

[Claim(s)]
[Claim 1]
The 1st inverter,
The 2nd inverter,
2Y motor which uses as a stator the 1st three-phase-motor coil by which energization control is carried out with said 1st inverter, and the 2nd three-phase-motor coil by which energization control is carried out with said 2nd inverter,
The power source connected between the 1st neutral point of said 1st three-phase-motor coil, and the 2nd neutral point of said 2nd three-phase-motor coil,
A power output unit equipped with a different motor from said 2Y motor.
[Claim 2]
Said 2Y motor is a power output unit according to claim 1 which generates electricity on the turning effort from an internal combustion engine, and puts said internal combustion engine into operation.
[Claim 3]
The power output unit according to claim 2 further equipped with the planetary gear to which said 2Y motor, said motor, and said internal combustion engine are connected.
[Claim 4]
The 3rd inverter which drives said motor,
It has further the control unit which controls said 1st, 2nd, and 3rd inverters,
Said control device is a power output unit given in any 1 term of claim 1 to claim 3 which drives said 3rd inverter so that said motor may be driven by the generated output which said 2Y motor generated, while controlling said 1st and 2nd inverters so that said 2Y motor functions as a generator.
[Claim 5]
Said control unit is a power output unit according to claim 4 which separates said power source from said 1st and 2nd neutral points further.
[Claim 6]
It has further the relay means established between said 1st and 2nd neutral points and said power sources,
Said relay means is a power output unit according to claim 5 which performs connection/separation for said power source at said 1st and 2nd neutral points according to the control from said control unit.
[Claim 7]
It is the motorised approach of driving 2Y motor connected with the internal combustion engine of a hybrid car, and the motor connected with the driving wheel of said hybrid car,
The 1st step which calculates the 1st power of said 2Y motor, and the 2nd power of said motor,
The 2nd step which judges whether the sum of said 1st calculated power and said 2nd power is zero,
The motorised approach containing the 3rd step which separates a power source from the neutral point of two three-phase-circuit coils contained in said 2Y motor when said sum is zero.
[Claim 8]
The 4th step which drives said 2Y motor as a generator,
The motorised approach according to claim 7 which contains further the 5th step which drives said motor with the power generated by said 2Y motor.
[Claim 9]
The 6th step which drives said 2Y motor as a motor while making the capacitor formed in the input side of the inverter which carries out the pressure up of the electrical potential difference from said power source, and drives said 2Y motor when said sum is not zero charge,

The motorised approach according to claim 7 or 8 which contains further the 7th step which drives said 2Y motor as a generator while lowering the pressure of the direct current voltage from said capacitor and making said power source charge when said sum is not zero.
[Claim 10]
It is the record medium which recorded the program for making a computer perform drive control with 2Y motor connected with the internal combustion engine of a hybrid car, and the motor connected with the driving wheel of said hybrid car and in which computer read is possible,
The 1st step which calculates the 1st power of said 2Y motor, and the 2nd power of said motor,
The 2nd step which judges whether the sum of said 1st calculated power and said 2nd power is zero,
The record medium which recorded the program for making a computer perform the 3rd step which separates a power source from the neutral point of two three-phase-circuit coils contained in said 2Y motor when said sum is zero and in which computer read is possible.
[Claim 11]
The 4th step which drives said 2Y motor as a generator,
The record medium which recorded the program for performing a computer according to claim 10 which makes a computer perform further the 5th step which drives said motor with the power generated by said 2Y motor and in which computer read is possible.
[Claim 12]
The 6th step which drives said 2Y motor as a motor while making the capacitor formed in the input side of the inverter which carries out the pressure up of the electrical potential difference from said power source, and drives said 2Y motor when said sum is not zero charge,
The record medium which recorded the program for performing a computer according to claim 10 or 11 which makes a computer perform further the 7th step which drives said 2Y motor as a generator while lowering the pressure of the direct current voltage from said capacitor and making said power source charge when said sum is not zero and in which computer read is possible.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
Especially this invention relates to the record medium which recorded the program for making a computer perform drive control of the power output unit using a double coil motor, the motorised approach, and a motor and in which computer read is possible about a power output unit.
[0002]
[Description of the Prior Art]
Conventionally, as a power output unit using a double coil motor, the power output unit indicated by JP,2002-218793,A is known. The conventional power output unit 300 is equipped with the double coil motor 310, DC power supply 320, an inverter 330,340, and a capacitor 350 with reference to drawing 10 .
[0003]
The double coil motor 310 contains two three-phase-circuit coils 311,312. And DC power supply 320 are connected between the neutral point of the three-phase-circuit coil 311, and the neutral point of the three-phase-circuit coil 312.
[0004]
An inverter 330 performs energization control to the three-phase-circuit coil 311 including three arms corresponding to U phase coil of the three-phase-circuit coil 311, V phase coil, and W phase coil, respectively. Moreover, an inverter 340 performs energization control to the three-phase-circuit coil 312 including three arms corresponding to U phase coil of the three-phase-circuit coil 312, V phase coil, and W phase coil, respectively. A capacitor 350 and an inverter 330,340 are connected to juxtaposition between the positive-electrode bus-bar 301 and the negative-electrode bus-bar 302.
[0005]
The potential difference of the neutral point of the three-phase-circuit coil 311 and the neutral point of the three-phase-circuit coil 312 is set to V012, and the electrical potential difference of DC power supply 320 is set to Vb. When it is V012<Vb, a direct current flows out of DC power supply 320. And by carrying out switching control of the one arm of the inverters 330 or 340 corresponding to one coil of the three-phase-circuit coil 311,312, the direct current which flowed out of DC power supply 320 is accumulated in one coil of the three-phase-circuit coil 311,312, and, finally charges a capacitor 350. That is, a pressure-up converter is constituted by one coil of the three-phase-circuit coil 311,312, and one arm of an inverter 330,340, the pressure up of the direct current voltage Vb is carried out to the level of arbitration by the pressure-up converter, and it charges a capacitor 350.
[0006]
On the other hand, at the time of V012>Vb, the pressure of the electrical potential difference of the both ends of a capacitor 350 is lowered with one coil of the three-phase-circuit coil 311,312 corresponding to one arm and one arm of an inverter 330,340, and it charges DC power supply 320.
[0007]
Moreover, with the electrical potential difference of the both ends of a capacitor 350, an inverter 330,340 performs energization control to the three-phase-circuit coil 311,312, and drives the double coil motor 310, respectively. And according to the drive conditions of the double coil motor 310, the electrical potential differences impressed to each phase coil of the three-phase-circuit coil 311,312 differ, and the potential difference V012 of the neutral point of the three-phase-circuit coil 311 and the neutral point of the three-phase-circuit coil 312 becomes larger than direct current voltage Vb, or becomes small. Consequently, as mentioned above, the mode in which a capacitor 350 is charged by DC power supply 320, and the mode in

which DC power supply 320 are charged by the capacitor 350 arise.
[0008]
Thus, in the power output unit 300, the pressure up of the direct current voltage Vb of DC power supply 320 is carried out to the level of arbitration using some coils of the double coil motor 310, and it charges a capacitor 350. And the double coil motor 310 drives with the electrical potential difference of the both ends of the charged capacitor 350. Moreover, the pressure of the electrical potential difference of the both ends of a capacitor 350 is lowered, and it charges DC power supply 320.
[0009]
[Patent reference 1]
JP,2002-218793,A
[0010]
[Patent reference 2]
The patent No. 3216589 official report
[0011]
[Patent reference 3]
JP,2002-171606,A
[0012]
[Problem(s) to be Solved by the Invention]
However, the power output unit applied to the hybrid car of a machine distribution type is not proposed by JP,2002-218793,A.
[0013]
So, the purpose of this invention is offering the power output unit suitable for the hybrid car of a machine distribution type.
[0014]
Moreover, another purpose of this invention is offering the motorised approach suitable for the hybrid car of a machine distribution type.
[0015]
Furthermore, another purpose of this invention is offering the record medium which recorded the program for making a computer perform drive control of the motor suitable for the hybrid car of a machine distribution type and in which computer read's is possible.
[0016]
[The means for solving a technical problem and an effect of the invention]
According to this invention, a power output unit is equipped with the 1st inverter, the 2nd inverter, 2Y motor, a power source, and a motor. 2Y motor uses as a stator the 1st three-phase-motor coil by which energization control is carried out with the 1st inverter, and the 2nd three-phase-motor coil by which energization control is carried out with the 2nd inverter. A power source is connected between the 1st neutral point of the 1st three-phase-motor coil, and the 2nd neutral point of the 2nd three-phase-motor coil. A motor differs from 2Y motor.
[0017]
Preferably, 2Y motor generates electricity on the turning effort from an internal combustion engine, and puts an internal combustion engine into operation.
[0018]
Preferably, a power output unit is further equipped with a planetary gear. As for a planetary gear, 2Y motor, a motor, and an internal combustion engine are connected.
[0019]
Preferably, a power output unit is further equipped with the 3rd inverter and a control unit. The 3rd inverter drives a motor. A control device controls the 1st, 2nd, and 3rd inverters. And while controlling said 1st and 2nd inverters so that 2Y motor functions as a generator, a control device drives the 3rd inverter, as it drives a motor by the generated output which 2Y motor generated.
[0020]
Preferably, a control unit separates a power source from said 1st and 2nd neutral points further.
[0021]
Preferably, a power output unit is further equipped with a relay means. A relay means is established between the 1st and 2nd neutral points and a power source. And a relay means performs connection/separation for a power source at the 1st and 2nd neutral points according to the control from a control unit.
[0022]

According to this invention, moreover, the motorised approach It is the motorised approach of driving 2Y motor connected with the internal combustion engine of a hybrid car, and the motor connected with the driving wheel of a hybrid car. The 1st step which calculates the 1st power of 2Y motor, and the 2nd power of a motor, the 2nd step which judges whether the sum of the 1st power and the 2nd power which were calculated is zero, and when the sum is zero, The 3rd step which separates a power source from the neutral point of two three-phase-circuit coils contained in 2Y motor is included.
[0023]
Preferably, the motorised approach contains further the 4th step which drives 2Y motor as a generator, and the 5th step which drives a motor with the power generated by 2Y motor.
[0024]
The 6th step which drives 2Y motor as a motor preferably while the motorised approach makes the capacitor formed in the input side of the inverter which carries out the pressure up of the electrical potential difference from a power source, and drives 2Y motor charge, when the sum is not zero, When the sum is not zero, the 7th step which drives 2Y motor as a generator is included further, lowering the pressure of the direct current voltage from a capacitor, and making a power source charge.
[0025]
Furthermore, 2Y motor which was connected with the internal combustion engine of a hybrid car according to this invention, The record medium which recorded the program for making a computer perform drive control with the motor connected with the driving wheel of a hybrid car and in which computer read is possible The 1st step which calculates the 1st power of 2Y motor, and the 2nd power of a motor, the 2nd step which judges whether the sum of the 1st power and the 2nd power which were calculated is zero, and when the sum is zero, It is the record medium which recorded the program for making a computer perform the 3rd step which separates a power source from the neutral point of two three-phase-circuit coils contained in 2Y motor and in which computer read is possible.
[0026]
A program makes a computer perform further preferably the 4th step which drives 2Y motor as a generator, and the 5th step which drives a motor with the power generated by 2Y motor.
[0027]
The 6th step which drives 2Y motor as a motor preferably while a program makes the capacitor formed in the input side of the inverter which carries out the pressure up of the electrical potential difference from a power source, and drives 2Y motor charge, when the sum is not zero, A computer is made to perform further the 7th step which drives 2Y motor as a generator, when the sum is not zero, lowering the pressure of the direct current voltage from a capacitor, and making a power source charge.
[0028]
In this invention, when driving a motor with the power generated by 2Y motor, a power source is separated from the neutral point of two three-phase-circuit coils contained in 2Y motor. Therefore, the generating efficiency of 2Y motor can be raised and a motor can be operated in the large range.
[0029]
Moreover, pressure-lowering actuation for charging the pressure-up actuation or the power source which carries out the pressure up of the electrical potential difference of a power source is performed by 2Y motor which does not drive the driving wheel of a hybrid car. Therefore, effectiveness of a motor in which the driving wheel of a hybrid car is driven is made to max.
[0030]
[Embodiment of the Invention]
It explains to a detail, referring to a drawing about the gestalt of operation of this invention. In addition, the same sign is given to the same or a considerable part among drawing, and the explanation is not repeated.
[0031]
Drawing 1 shows the outline block diagram of the power output unit by the gestalt of implementation of this invention. With reference to drawing 1 , the power output unit 100 by the gestalt of implementation of this invention is equipped with the power transfer gear 111, a driving shaft 112, a differential gear 114, motor generators MG1 and MG2, a planetary gear 120, the power fetch gear 128, a chain belt 129, an engine 150, a resolver 139,149,159, a damper 157, and a control unit 180.
[0032]
The crankshaft 156 of an engine 150 is connected to a planetary gear 120 and motor generators MG1 and MG2 through a damper 157. A damper 157 controls the amplitude of the torsional oscillation of the crankshaft 156 of an engine 150, and connects a crankshaft 156 to a planetary gear 120.

[0033]
The power fetch gear 128 is connected to the power transfer gear 111 through a chain belt 129. And the power fetch gear 128 receives power from the ring gear (not shown) of a planetary gear 120, and transmits the received power to the power transfer gear 111 through a chain belt 129. The power transfer gear 111 transmits power to a driving wheel through a driving shaft 112 and a differential gear 114.
[0034]
With reference to drawing 2 , a planetary gear 120 and motor generators MG1 and MG2 are explained to a detail. With Sun Geer 121 combined with the Sun Geer shaft 125 in the air with which the planetary gear 120 penetrated the shaft center on the carrier shaft 127 The ring gear 122 combined with the carrier shaft 127 and the ring gear shaft 126 of the same axle, Two or more planetary pinion gears 123 which revolve around the sun while it is arranged between Sun Geer 121 and a ring gear 122 and Sun Geer's 121 periphery is rotated, It is combined with the edge of the carrier shaft 127, and consists of planetary carriers 124 which support the revolving shaft of each planetary pinion gear 123 to revolve.
[0035]
In this planetary gear 120, decision of the power with which 3 of the Sun Geer shaft 125 combined with Sun Geer 121, the ring gear 122, and the planetary carrier 124, respectively, the ring gear shaft 126, and the carrier shaft 127 shafts are used as the I/O shaft of power, and are outputted and inputted to any 2 shafts of three shafts fixes the power outputted and inputted by the one remaining shaft based on the power outputted and inputted biaxial [which was determined].
[0036]
In addition, the resolver 139,149,159 which detects each angle-of-rotation thetas, thetar, and thetac is formed in the Sun Geer shaft 125, the ring gear shaft 126, and the carrier shaft 127.
[0037]
The power fetch gear 128 for the ejection of power is combined with the ring gear 122. This power fetch gear 128 is connected to the power transfer gear 111 by the chain belt 129, and transfer of power is made between the power fetch gear 128 and the power transfer gear 111.
[0038]
A motor generator MG 1 is constituted as a synchronous motor generator, and is equipped with Rota 132 which has two or more permanent magnets 135 in a peripheral face, and the stator 133 around which the three-phase-circuit coil 134 which forms rotating magnetic field was wound. In addition, the three-phase-circuit coil 134 consists of two three-phase-circuit coils so that it may mention later.
[0039]
Rota 132 is combined with the Sun Geer shaft 125 combined with Sun Geer 121, a planetary gear 120. A stator 133 carries out the laminating of the sheet metal of a non-oriented magnetic steel sheet, is formed, and is being fixed to the case 119. This motor generator MG 1 operates as a motor which carries out the rotation drive of Rota 132 by the interaction of the field by the permanent magnet 135, and the field formed with the three-phase-circuit coil 134, and operates as a generator which makes the both ends of the three-phase-circuit coil 134 produce electromotive force by the interaction of the field by the permanent magnet 135, and rotation of Rota 132.
[0040]
A motor generator MG 2 is equipped with Rota 142 which has two or more permanent magnets 145 in a peripheral face, and the stator 143 around which the three-phase-circuit coil 144 which forms rotating magnetic field was wound. Rota 142 is combined with the ring gear shaft 126 combined with the ring gear 122 of a planetary gear 120, and the stator 143 is being fixed to the case 119. A stator 143 also carries out the laminating of the sheet metal of a non-oriented magnetic steel sheet, and is formed. It operates as a motor or a generator like [this motor generator MG 2] a motor generator MG 1.
[0041]
Drawing 1 is referred to again. A control device 180 Angle-of-rotation thetas of the Sun Geer shaft 125 from a resolver 139, Angle-of-rotation thetar of the ring gear shaft 126 from a resolver 149, angle-of-rotation thetac of the carrier shaft 127 from a resolver 159, The accelerator pedal position AP from accelerator pedal position-sensor 164a (the amount of treading in of an accelerator pedal) The brake-pedal position BP from brake-pedal position-sensor 165a (the amount of treading in of a brake pedal), The shift position SP from the shift position sensor 185 The motor current MCRT2 from the current sensor (not shown) attached in the motor current 11 and MCRT 12 and a motor generator MG 2 from two current sensors (not shown) attached in the motor generator MG 1 is received.
[0042]

And a control device 180 controls the current passed in the three-phase-circuit coil 134,144 of motor generators MG1 and MG2 based on carrier beam each of these signals, and drives motor generators MG1 and MG2.
[0043]
Drawing 3 shows the electrical diagram of the principal part of the power output unit 100. drawing 3 -- referring to -- the power output unit 100 -- motor generators MG1 and MG2 and current sensor 12- it has 14, 31, DC power supply 30, relay 40, a capacitor 50, a voltage sensor 51, inverters 181-183, and control (Central Processing Unit) CPU 184.
[0044]
In addition, inverters 181-183 and control CPU 184 constitute the control unit 180 shown in drawing 1 .
[0045]
A motor generator MG 1 contains two three-phase-circuit coils 10 and 11. And two three-phase-circuit coils 10 and 11 constitute the three-phase-circuit coil 134 shown in drawing 2 . That is, a motor generator MG 1 is a double coil motor (it is also called "2Y motor".) which has two three-phase-circuit coils 10 and 11 by which connection was carried out to Y mold.
[0046]
DC power supply 30 are connected through relay 40 between the neutral point M1 of the three-phase-circuit coil 10, and the neutral point M2 of the three-phase-circuit coil 11.
[0047]
An inverter 181 contains U phase arm 15, V phase arm 16, and W phase arm 17. U phase arm 15, V phase arm 16, and W phase arm 17 are formed in juxtaposition between power-source Rhine 1 and an earth line 2.
[0048]
U phase arm 15 consists of NPN transistors Q1 and Q2 connected to the serial between power-source Rhine 1 and an earth line 2. V phase arm 16 consists of NPN transistors Q3 and Q4 connected to the serial between power-source Rhine 1 and an earth line 2. W phase arm 17 consists of NPN transistors Q5 and Q6 connected to the serial between power-source Rhine 1 and an earth line 2.
[0049]
A collector is connected to power-source Rhine 1, and, as for NPN transistors Q1, Q3, and Q5, an emitter is connected to the collector of NPN transistors Q2, Q4, and Q6, respectively. The emitter of NPN transistors Q2, Q4, and Q6 is connected to an earth line 2. Moreover, between the emitter-collectors of each NPN transistors Q1-Q6, the diodes D1-D6 which pass a current are connected to the collector side from the emitter side, respectively.
[0050]
An inverter 182 contains U phase arm 18, V phase arm 19, and W phase arm 20. U phase arm 18, V phase arm 19, and W phase arm 20 are formed in juxtaposition between power-source Rhine 1 and an earth line 2.
[0051]
U phase arm 18 consists of NPN transistors Q7 and Q8 connected to the serial between power-source Rhine 1 and an earth line 2. V phase arm 19 consists of NPN transistors Q9 and Q10 connected to the serial between power-source Rhine 1 and an earth line 2. W phase arm 20 consists of NPN transistors Q11 and Q12 connected to the serial between power-source Rhine 1 and an earth line 2.
[0052]
A collector is connected to power-source Rhine 1, and, as for NPN transistors Q7, Q9, and Q11, an emitter is connected to the collector of NPN transistors Q8, Q10, and Q12, respectively. The emitter of NPN transistors Q8, Q10, and Q12 is connected to an earth line 2. Moreover, between the emitter-collectors of each NPN transistors Q7-Q12, the diodes D7-D12 which pass a current are connected to the collector side from the emitter side, respectively.
[0053]
The midpoint of each phase arm of an inverter 181 is connected to each **** of each phase coil of the three-phase-circuit coil 10 of a motor generator MG 1, and the midpoint of each phase arm of an inverter 182 is connected to each **** of each phase coil of the three-phase-circuit coil 11 of a motor generator MG 1. That is, common connection of the end of three coils, U phase of the three-phase-circuit coil 10, V phase, and W phase, is made, it is constituted at the neutral point M1, the other end of V phase coil is connected to the midpoint of NPN transistors Q3 and Q4, and the other end of W phase coil is connected to the midpoint of NPN transistors Q5 and Q6 for the other end of U phase coil at the midpoint of NPN transistors Q1 and Q2, respectively. Moreover, common connection of the end of three coils, U phase of the three-phase-circuit coil 11, V phase, and W phase, is made, it is constituted at the neutral point M2, the other end of V phase coil is

connected to the midpoint of NPN transistors Q9 and Q10, and the other end of W phase coil is connected to the midpoint of NPN transistors Q11 and Q12 for the other end of U phase coil at the midpoint of NPN transistors Q7 and Q8, respectively.

[0054]

An inverter 183 contains U phase arm 21, V phase arm 22, and W phase arm 23. U phase arm 21, V phase arm 22, and W phase arm 23 are formed in juxtaposition between power-source Rhine 1 and an earth line 2.

[0055]

U phase arm 21 consists of NPN transistors Q13 and Q14 connected to the serial between power-source Rhine 1 and an earth line 2. V phase arm 22 consists of NPN transistors Q15 and Q16 connected to the serial between power-source Rhine 1 and an earth line 2. W phase arm 23 consists of NPN transistors Q17 and Q18 connected to the serial between power-source Rhine 1 and an earth line 2.

[0056]

A collector is connected to power-source Rhine 1, and, as for NPN transistors Q13, Q15, and Q17, an emitter is connected to the collector of NPN transistors Q14, Q16, and Q18, respectively. The emitter of NPN transistors Q14, Q16, and Q18 is connected to an earth line 2. Moreover, between the emitter-collectors of each NPN transistors Q13-Q18, the diodes D13-D18 which pass a current are connected to the collector side from the emitter side, respectively.

[0057]

The midpoint of each phase arm of an inverter 183 is connected to each **** of each phase coil of a motor generator MG 2. That is, a motor generator MG 2 is the permanent magnet motor of a three phase circuit, common connection of the end of three coils, U phase, V phase, and W phase, is made, it is constituted at the middle point, the other end of V phase coil is connected to the midpoint of NPN transistors Q15 and Q16, and the other end of W phase coil is connected to the midpoint of NPN transistors Q17 and Q18 for the other end of U phase coil at the midpoint of NPN transistors Q13 and Q14, respectively.

[0058]

A capacitor 50 is connected to inverters 181-183 between power-source Rhine 1 and an earth line 2 at juxtaposition.

[0059]

A current sensor 12 detects the motor current MCRT11 which flows in the three-phase-circuit coil 10 of a motor generator MG 1, and outputs the detected motor current MCRT11 to control CPU 184. A current sensor 13 detects the motor current MCRT12 which flows in the three-phase-circuit coil 11 of a motor generator MG 1, and outputs the detected motor current MCRT12 to control CPU 184. A current sensor 14 detects the motor current MCRT2 which flows in each phase coil of a motor generator MG 2, and outputs the detected motor current MCRT2 to control CPU 184.

[0060]

DC power supply 30 consist of rechargeable batteries, such as nickel hydrogen or a lithium ion. A current sensor 31 detects the direct current BCRT outputted and inputted to DC power supply 30, and outputs the detected direct current BCRT to control CPU 184.

[0061]

Relay 40 is turned on / turned off by the signal SE from control CPU 184. Relay 40 is turned on by the signal SE of H (logic yes) level from control CPU 184, and, more specifically, is turned off by the signal SE of L (logic low) level from control CPU 184.

[0062]

A capacitor 50 graduates the direct current voltage impressed between power-source Rhine 1 and an earth line 2, and supplies the graduated direct current voltage to inverters 181-183. A voltage sensor 51 detects the electrical potential difference Vc of the both ends of a capacitor 50, and outputs the detected electrical potential difference Vc to control CPU 184.

[0063]

An inverter 181 changes into alternating voltage the direct current voltage supplied from the capacitor 50 based on the signal PWMI1 from control CPU 184, and impresses it to each phase coil of the three-phase-circuit coil 10. Moreover, an inverter 182 changes into alternating voltage the direct current voltage supplied from the capacitor 50 based on the signal PWMI2 from control CPU 184, and impresses it to each phase coil of the three-phase-circuit coil 11. Thereby, an inverter 181,182 drives a motor generator MG 1. In addition, when DC power supply 30 are connected by the relay 40 between the neutral point M1 and the neutral point M2, an inverter 181,182 passes the alternating current superimposed on the direct current outputted from DC power supply 30 according to the signal 1 and PWMI 2, respectively in each phase coil of the three-

phase-circuit coils 10 and 11.
[0064]
Moreover, an inverter 181 changes into direct current voltage the alternating voltage generated in the three-phase-circuit coil 10 according to the signal PWMC1 from control CPU 184, and supplies it to a capacitor 50. An inverter 182 changes into direct current voltage the alternating voltage generated in the three-phase-circuit coil 11 according to the signal PWMC2 from control CPU 184, and supplies it to a capacitor 50. In addition, when DC power supply 30 are connected by the relay 40 between the neutral point M1 and the neutral point M2, according to a signal 1 and PWMC 2, an inverter 181,182 lowers the pressure of the direct current voltage from a capacitor 50, and charges DC power supply 30 with the direct current voltage whose pressure was lowered, respectively.
[0065]
According to the signal PWMI3 from control CPU 184, an inverter 183 changes the direct current voltage from a capacitor 50 into alternating voltage, and drives a motor generator MG 2. Moreover, an inverter 183 changes into direct current voltage the alternating voltage which the motor generator MG 2 generated according to the signal PWMC3 from control CPU 184, and supplies it to a capacitor 50.
[0066]
Control CPU 184 calculates engine command power, the generator command torque (motor generator MG1 command torque) TR1, and the motor command torque (motor generator MG2 command torque) TR2 based on the accelerator pedal position AP from accelerator pedal position-sensor 164a, the brake-pedal position BP from brake-pedal position-sensor 165a, and the shift position SP from the shift position sensor 185.
[0067]
And control CPU 184 carries out the multiplication of the generator command torque TR1 and the rotational frequency which calculated and calculated the rotational frequency of a generator (motor generator MG 1) based on angle-of-rotation thetas from a resolver 139, and calculates the generator power Pg. Moreover, control CPU 184 carries out the multiplication of the generator command torque TR2 and the rotational frequency which calculated and calculated the rotational frequency of a motor (motor generator MG 2) based on angle-of-rotation thetar from a resolver 149, and calculates the motor power Pm. And control CPU 184 judges whether sum Pm+Pg of the motor power Pm and the generator power Pg is zero, when sum Pm+Pg is zero, separates DC power supply 30 from the neutral points M1 and M2, and drives motor generators MG1 and MG2. On the other hand, when sum Pm+Pg is not zero, control CPU 184 drives motor generators MG1 and MG2, connecting DC power supply 30 at the neutral points M1 and M2.
[0068]
Moreover, control CPU 184 calculates current command value Id1* of a motor generator MG 1, Iq1*, and capacitor electrical-potential-difference command value Vc* of a capacitor 50 based on the calculated generator command torque TR1. Furthermore, control CPU 184 calculates current command value Id2* of a motor generator MG 2, and Iq2* based on the calculated motor command torque TR2.
[0069]
When it does so, control CPU 184 The motor current 11 and MCRT 12 from current sensors 12 and 13 Angle-of-rotation thetas from the resolver 139 installed in the Sun Geer shaft 125 with which a direct current BCRT from a current sensor 31 and the revolving shaft of a motor generator MG 1 were combined, Based on calculated current command value Id1*, Iq1*, and capacitor electrical-potential-difference command value Vc*, the signals [1 and PWMC / PWMI and / 2] 1 and 2 are generated. The generated signals PWMI1 and PMWC1 are outputted to an inverter 181, and the generated signals PWMI2 and PMWC2 are outputted to an inverter 181.
[0070]
Moreover, control CPU 184 generates signals PWMI3 and PWMC3 based on the motor current MCRT2 from a current sensor 14, angle-of-rotation thetar from the resolver 149 installed in the ring gear shaft 126 with which the revolving shaft of a motor generator MG 2 was combined, and calculated current command value Id2* and Iq2*, and outputs the generated signals PWMI3 and PWMC3 to an inverter 183.
[0071]
Drawing 4 shows the plane configuration Fig. of the three-phase-circuit coils 10 and 11 of a motor generator MG 1. Generally a motor generator MG 1 contains the three-phase-circuit coil 10 and the three-phase-circuit coil 11 which could shift only alpha to the hand of cut and was wound around it to the three-phase-circuit coil 10. That is, a motor generator MG 1 can also be considered to be 6 phase motor.
[0072]
In the gestalt of this operation, it is explained that an include angle alpha is 0 times. That is, two three-

phase-circuit coils 10 and 11 are in phase, and are wound. Therefore, an inverter 181,182 is in phase and should just pass alternating current in the three-phase-circuit coils 10 and 11. That is, in U phase coil of the three-phase-circuit coil 10, V phase coil, and W phase coil, it is as in phase as U phase coil of the three-phase-circuit coil 11, V phase coil, and W phase coil, and alternating current flows in them, respectively.

[0073]

With reference to drawing 5 and drawing 6 , the motor generator MG 1 when DC power supply 30 are connected between the neutral point M1 and the neutral point M2, and the principle of operation of an inverter 181,182 are explained.

[0074]

Drawing 5 is a circuit diagram for explaining to the leakage inductance of U phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 paying attention to the flow of the current in the condition that the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 is smaller than the electrical potential difference Vb of DC power supply 30.

[0075]

The condition of ON of NPN transistor Q2 of an inverter 181 or the condition of ON of NPN transistor Q7 of an inverter 182 is considered in the condition that the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 is smaller than the electrical potential difference Vb of DC power supply 30.

[0076]

In this case, the short circuit shown by the continuous-line arrow head is formed into (a) of drawing 5 , and (b) of drawing 5 , and U phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 functions as a reactor. If NPN transistor Q7 of an inverter 182 is turned off while turning off NPN transistor Q2 of an inverter 181 from this condition, the energy accumulated in U phase of the three-phase-circuit coils 10 and 11 which are functioning as a reactor will be accumulated in a capacitor 50 by the charge circuit shown by the continuous-line arrow head in (c) of drawing 5 . Therefore, this circuit can carry out the pressure up of the direct current voltage Vb of DC power supply 30, and can consider that it is the capacitor charge circuit which charges a capacitor 50 with that direct current voltage that carried out the pressure up.

[0077]

And since pressure-up level can be freely set up according to the "on" period of NPN transistors Q2 or Q7, the electrical potential difference Vc of the both ends of a capacitor 50 can be operated on the electrical potential difference of arbitration higher than the electrical potential difference Vb of DC power supply 30.

[0078]

Also about V phase and W phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 Since it can be regarded as a capacitor charge circuit like U phase, while the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 considers as a condition smaller than the electrical potential difference Vb of DC power supply 30 By turning on / turning off NPN transistors Q2, Q4, and Q6 of an inverter 181, or NPN transistors Q7, Q9, and Q11 of an inverter 182, the pressure up of the electrical potential difference Vb of DC power supply 30 is carried out, and a capacitor 50 can be charged.

[0079]

Drawing 6 shows the circuit diagram for explaining to the leakage inductance of U phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 paying attention to the flow of the current in the condition that the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 is larger than the electrical potential difference Vb of DC power supply 30.

[0080]

NPN transistor Q1 of an inverter 181 is turned on in the condition that the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 is larger than the electrical potential difference Vb of DC power supply 30, NPN transistor Q2 is turned off, NPN transistor Q7 of an inverter 182 is turned off, and the condition that NPN transistor Q8 was turned on is considered. In this case, the charge circuit shown by the continuous-line arrow head is formed into (a) of drawing 6 , and DC power supply 30 are charged using the electrical potential difference Vc between terminals of a capacitor 50. At this time, it functions as having mentioned above U phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 as a reactor. If NPN transistor Q1 of an inverter 181 is turned off from this condition or NPN transistor Q8 of an inverter 182 is turned off, the energy stored in U phase of

the three-phase-circuit coils 10 and 11 which are functioning as a reactor will charge DC power supply 30 by the charge circuit shown by the continuous-line arrow head in (b) of drawing 6 , or (c) of drawing 6 .
[0081]
Therefore, it can be considered that this circuit is the DC-power-supply charge circuit which stores the energy of a capacitor 50 in DC power supply 30. Since it can consider that V phase and W phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 as well as U phase are also a DC-power-supply charge circuit While the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 considers as a larger condition than the electrical potential difference Vb of DC power supply 30 By turning on / turning off NPN transistors Q1-Q6 of an inverter 181, or NPN transistors Q7-Q12 of an inverter 182, DC power supply 30 can be charged with the energy accumulated in the capacitor 50.
[0082]
Thus, in the power output unit 100, since a capacitor 50 can be charged by DC power supply 30 or DC power supply 30 can be charged by the capacitor 50, the electrical potential difference Vc between terminals of a capacitor 50 is controllable to a predetermined value.
[0083]
If the potential difference is produced between the terminals of a capacitor 50, since it will be in the condition that the DC power supply by the capacitor 50 were connected, between power-source Rhine 1 and the earth lines 2 to which the inverter 181,182 was connected and the electrical potential difference Vc between terminals of a capacitor 50 will act as inverter input voltage Vi, the drive control of the 2Y motor MG 1 can be carried out by carrying out switching control of NPN transistors Q1-Q6 of an inverter 181,182, and Q7-Q12.
[0084]
In this case, the potentials Vu1, Vv1, and Vw1 of each phase of the three-phase alternating current impressed to the three-phase-circuit coil 10 While being able to set up freely within the limits of the inverter input voltage Vi by the switching control of NPN transistors Q1-Q6 of an inverter 181 The potentials Vu2, Vv2, and Vw2 of each phase of the three-phase alternating current impressed to the three-phase-circuit coil 11 Since it can set up freely within the limits of the inverter input voltage Vi by the switching control of NPN transistors Q7-Q12 of an inverter 182 The potential V01 of the neutral point M1 of the three-phase-circuit coil 10 of the 2Y motor MG 1 and the potential V02 of the neutral point M2 of the three-phase-circuit coil 11 can be operated freely.
[0085]
The wave form chart of the potentials Vu1, Vv1, and Vw1 ((a) of drawing 7) of the three-phase-circuit coil 10 when operating it so that the difference of the potential V01 of the neutral point M1 of the three-phase-circuit coil 10 and the potential V02 of the neutral point M2 of the three-phase-circuit coil 11 may be in agreement with drawing 7 at the electrical potential difference Vb of DC power supply 30, and the potentials Vu2, Vv2, and Vw2 ((b) of drawing 7) of the three-phase-circuit coil 11 is shown. In drawing 7 , Vx is the median (Vi/2) of the inverter input voltage Vi. Therefore, it is operated so that the potential difference V012 during the neutral point of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 may become lower than the electrical potential difference Vb of DC power supply 30, and it can be operated so that the potential difference V012 during the neutral point of the three-phase-circuit coils 10 and 11 may become higher than the electrical potential difference Vb of DC power supply 30 conversely, and a capacitor 50 can be charged or DC power supply 30 can also be charged. And the charging current of a capacitor 50 or the charging current of DC power supply 30 is controllable by going up and down the neutral point M1 of the three-phase-circuit coils 10 and 11, and the potential difference V012 between M2.
[0086]
Drawing 8 shows the functional block diagram of the control CPU 184 which generates the signals [1-PWMC / PWMI and / 3] 1-3. With reference to drawing 8 , control CPU 184 contains the current transducer 1841, subtractors 1842 and 1852, the PI control sections 1843, 1853, and 1855, adders 1844 and 1846, a transducer 1845, the PWM operation part 1847, the rotational-speed operation part 1849, the speed-electromotive-force prediction operation part 1850, the cell current prediction operation part 1851, and an adder subtracter 1854.
[0087]
First, the function of the control CPU 184 which generates a signal 1 and PWMI 2 and a signal 1 and PWMC 2 is explained. The current transducer 1841 carries out three phase two phase conversion using angle-of-rotation thetas to which the resolver 139 detected the motor current 11 and MCRT 12 which

current sensors 12 and 13 detected. That is, the current transducer 1841 transforms the motor current 11 and MCRT 12 of the three phase circuit which flows to each phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 into the current values Id and Iq which flow on d shaft and q shaft using angle-of-rotation thetas, and outputs it to a subtractor 1842.
[0088]
A subtractor 1842 subtracts the current values Id and Iq from the current transducer 1841 from current command value Id1* calculated by control CPU 184 as one of the command values about the drive of the 2Y motor MG 1, and Iq1*, and calculates deflection delta Id and delta Iq. The PI control section 1843 calculates the control input for motor current adjustment using PI gain to deflection delta Id and delta Iq.
[0089]
The rotational-speed operation part 1849 calculates the rotational speed of the 2Y motor MG 1 based on angle-of-rotation thetas from a resolver 139, and outputs the calculated rotational speed to the speed-electromotive-force prediction operation part 1850 and the cell current prediction operation part 1851. The speed-electromotive-force prediction operation part 1850 calculates the forecast of speed electromotive force based on the rotational speed from the rotational-speed operation part 1849.
[0090]
An adder 1844 adds the control input for the motor current adjustment from the PI control section 1843, and the forecast of the speed electromotive force from the speed-electromotive-force prediction operation part 1850, and calculates the electrical-potential-difference control inputs Vd and Vq. A transducer 1845 carries out two phase three phase conversion of the electrical-potential-difference control inputs Vd and Vq from an adder 1844 using angle-of-rotation thetas from a resolver 139. That is, a transducer 1845 is changed into the control input of the electrical potential difference which impresses the control inputs Vd and Vq of the electrical potential difference impressed to d shaft and q shaft using angle-of-rotation thetas to three phases (U phase, V phase, and W phase) of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1.
[0091]
A subtractor 1852 subtracts the electrical potential difference Vc of the both ends of the capacitor 50 detected by the voltage sensor 51 from capacitor electrical-potential-difference command value Vc* which is the command value of the electrical potential difference of the both ends of the capacitor 50 calculated by control CPU 184, and calculates deflection deltaVc. The PI control section 1853 calculates the cell current control input for capacitor voltage adjustment using PI gain to deflection deltaVc. The cell current prediction operation part 1851 calculates the forecast of a cell current based on the rotational speed calculated by the rotational-speed operation part 1849, and current command value Id1* and Iq1*, and outputs the forecast of the calculated cell current to an adder subtracter 1854.
[0092]
An adder subtracter 1854 adds the forecast of the cell current from the cell current prediction operation part 1851, and the cell current control input from the PI control section 1853. And an adder subtracter 1854 receives the direct current BCRT outputted and inputted to DC power supply 30, i.e., a cell current, from a current sensor 31, subtracts the current current BCRT from the already calculated addition result, and outputs the subtraction result to the PI control section 1855. The PI control section 1855 sets up the neutral point M1 of the three-phase-circuit coils 10 and 11 for adjusting a cell current using PI gain to the output from an adder subtracter 1854, and the potential difference V012 between M2.
[0093]
An adder 1846 adds the potential difference V012 outputted from the PI control section 1855 to each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 outputted from the transducer 1845, and outputs the addition result to them to the PWM operation part 1847. The PWM operation part 1847 generates the signals [1 and PWMC / PWMI and / 2] 1 and 2 based on the output from an adder 1846. To each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 obtained by the transducer 1845 By a subtractor 1852, the PI control section 1853, the cell current prediction operation part 1851, the adder subtracter 1854, and the PI control section 1855 By adding the calculated neutral point M1 and the potential difference V012 between M2, and calculating an PWM signal (a signal 1 and PWMI 2 and a signal 1 and PWMC 2) It can consider as the wave offset from Median Vx so that the three-phase alternating current impressed to the three-phase-circuit coils 10 and 11 so that a current may be passed to DC power supply 30 and the electrical potential difference Vc of the capacitor 50 as inverter input voltage Vi may be held at command value Vc* might be illustrated to drawing 7 .
[0094]
Next, the function of the control CPU 184 which generates signals PWMI3 and PWMC3 is explained.

Signals PWMI3 and PWMC3 are generated by the current transducer 1841 and subtractor 1842 which were mentioned above, the PI control section 1843, an adder 1844, a transducer 1845, an adder 1846, the PWM operation part 1847, the rotational-speed operation part 1849, and the speed-electromotive-force prediction operation part 1850. And the current transducer 1841 performs three phase two phase conversion using angle-of-rotation thetar from a resolver 149. Moreover, a transducer 1845 performs two phase three phase conversion using angle-of-rotation thetar from a resolver 149. Furthermore, the rotational-speed operation part 1849 calculates rotational speed using angle-of-rotation thetar from a resolver 149. Furthermore, an adder 1846 is outputted to the PWM operation part 1847 as it is, without adding anything to each phase potentials Vu3, Vv3, and Vw3 (electrical potential difference impressed to each phase coil of a motor generator MG 2) from a transducer 1845. Thereby, the PWM operation part 1847 generates signals PWMI3 and PWMC3.

[0095]

With reference to drawing 9 , the actuation in the power output unit 100 is explained. If a series of actuation is started, control CPU 184 will receive driver demand torque. That is, control CPU 184 receives the accelerator position AP, the shift position SP, and the brake position BP (step S1). And control CPU 184 receives system information, such as an engine speed, temperature, and capacity (SOC:State Of Charge of a dc-battery) of DC power supply 30, (step S2).

[0096]

Then, control CPU 184 calculates engine command power, the generator command torque TR1, and the motor command torque TR2 based on various kinds of signals received at steps S1 and S2 (step S3). And control CPU 184 calculates the engine speed MRN1 of a motor generator MG 1 (generator) based on angle-of-rotation thetas from a resolver 139, and calculates the engine speed MRN2 of a motor generator MG 2 (motor) based on angle-of-rotation thetar from a resolver 149.

[0097]

If it does so, to the generator command torque TR1 and the motor command torque TR2 which were calculated in step S3, control CPU 184 will carry out the multiplication of the rotational frequencies MRN1 and MRN2, and will calculate the generator power Pg and the motor power Pm, respectively (step S4). And it judges whether control CPU 184 judged whether sum Pg+Pm of the generator power Pg and the motor power Pm was zero (step S5), and when sum Pg+Pm was not zero, it turned on the relay 40 last time further (step S6).

[0098]

In step S6, when judged with the relay 40 not being turned on last time, control CPU 184 generates the signal SE of H level, and outputs it to relay 40. Thereby, relay 40 is turned on and DC power supply 30 are connected at the neutral point M1 of the three-phase-circuit coil 10, and the neutral point M2 of the three-phase-circuit coil 11 (step S7). In step S6, when judged with the relay 40 having been turned on last time, a subtractor 1852, the PI control section 1853, the cell current prediction operation part 1851, an adder subtracter 1854, and the PI control section 1855 calculate the potential difference of the neutral point M1 of the three-phase-circuit coil 10, and the neutral point M2 of the three-phase-circuit coil 11, i.e., 2Y motor neutral point electrical-potential-difference command, by the approach mentioned above after step S7 (step S8). Then, it shifts to step S13.

[0099]

On the other hand, when judged with sum Pg+Pm being zero in step S5, as for control CPU 184, based on the current BCRT from a current sensor 31, a dc-battery current judges further whether it is zero (step S9). And in step S9, when judged with a dc-battery current not being zero, it shifts to step S8 mentioned above.

[0100]

In step S9, when it judges whether the relay 40 was turned off last time when judged with a dc-battery current being zero (step S10), and the relay 40 is not turned off, control CPU 184 generates the signal SE of L level, and outputs it to relay 40. Thereby, relay 40 is turned off and DC power supply 30 are separated from the neutral point M1 of the three-phase-circuit coil 10, and the neutral point M2 of the three-phase-circuit coil 11 (step S11). And when judged with the relay 40 having been turned off last time in step S10, Or the subtractor 1852 mentioned above, the PI control section 1853, the cell current prediction operation part 1851, an adder subtracter 1854, and the PI control section 1855 after step S11 Zero, i.e., 2Y motor neutral point electrical-potential-difference command, are calculated for the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10, and the neutral point M2 of the three-phase-circuit coil 11 with zero (step S12).

[0101]

And after step S8, where DC power supply 30 are connected between the neutral point M1 and the neutral point M2, a generator (motor generator MG 1) and a motor (motor generator MG 2) drive (step S13). Moreover, after step S12, where DC power supply 30 are separated from the neutral points M1 and M2, a generator (motor generator MG 1) and a motor (motor generator MG 2) drive (step S13).
[0102]
The path of step S5, S9-S12, and S13 is the path which a generator (motor generator MG 1) and a motor (motor generator MG 2) drive where DC power supply 30 are separated from the neutral points M1 and M2, i.e., the path which a motor generator MG 2 drives with the power which the motor generator MG 1 generated. In such the mode, if DC power supply 30 are connected between the neutral point M1 and M2, the electrical potential difference which can be impressed to each phase of the three-phase-circuit coils 10 and 11 of a motor generator MG 1 will become Vc-Vb, and the generating efficiency in a motor generator MG 1 will fall.
[0103]
A motor generator MG 2 is desirable in order for it to realize smooth transit of a hybrid car that an engine speed is controllable in the large range since it is a motor for driving the driving wheel of a hybrid car. Then, in order to improve the generating efficiency in a motor generator MG 1 and to make controllable the engine speed of a motor generator MG 2 in the large range, in the mode in which the motor generator MG 2 is driven, DC power supply 30 will be separated from the neutral points M1 and M2 with the power which the motor generator MG 1 generated.
[0104]
Moreover, steps S6-S8 and the path shown by S13 are paths which drive a generator (motor generator MG 1) and a motor (motor generator MG 2) where DC power supply 30 are connected at the neutral points M1 and M2. And in this path, by making the potential difference V012 of the neutral point M1 and the neutral point M2 go up and down, a motor generator MG 1 carries out the pressure up of the electrical potential difference Vb from DC power supply 30, charges a capacitor 50, or lowers the pressure of the electrical potential difference of the both ends of a capacitor 50, and charges DC power supply 30. However, since such pressure-up actuation and pressure-lowering actuation of an electrical potential difference are performed in the motor generator MG 1 which does not output the torque which drives the driving wheel of a hybrid car, effectiveness of the motor generator MG 2 which drives a driving wheel is made as for them to max.
[0105]
Thus, it sets to the power output unit 100. In the mode in which a motor (motor generator MG 2) is driven with the power generated with the generator (motor generator MG 1) Separate DC power supply 30 from the neutral points M1 and M2, improve the generating efficiency in a generator (motor generator MG 1), and a motor (motor generator MG 2) is operated in the large range. The motor generator MG 1 which does not drive a driving wheel in the mode in which a motor (motor generator MG 2) is not driven, with the power generated with the generator (motor generator MG 1) performs pressure-up actuation and pressure-lowering actuation of direct current voltage. When the power output unit 100 is applied to a hybrid car, it can be made to run a hybrid car smoothly by this.
[0106]
In addition, the motorised approach by this invention is the motorised approach of driving motor generators MG1 and MG2 according to the flow chart shown in drawing 9 .
[0107]
Moreover, drive control of the motor in control CPU 184 is performed by CPU (Central Processing Unit) in fact, and CPU controls the drive of motor generators MG1 and MG2 according to the flow chart which performs read-out and its read program from ROM (ReadOnly Memory), and shows a program equipped with each step of the flow chart shown in drawing 9 to drawing 9 . Therefore, ROM is equivalent to the record medium which recorded the program equipped with each step of the flow chart shown in drawing 9 and in which computer (CPU) read is possible.
[0108]
Again, with reference to drawing 3 , actuation of the power output unit 100 in light load transit mode, medium-speed low loading transit mode, acceleration and sudden acceleration mode, low mu way transit mode, and moderation / braking mode is explained at the time of start at the time of starting of the hybrid car with which the power output unit 100 was carried.
[0109]
First, actuation of the power output unit 100 at the time of engine starting of a hybrid car is explained. If a

series of actuation is started, control CPU 184 will generate the torque command value TR11 (a kind of the torque command value TR1) and the motor rotational frequency MRN1 for using a motor generator MG 1 for starting of an engine 150 according to the seizing signal from Outside ECU (Eletrical Control Unit). And control CPU 184 calculates current command value Id1* of a current, and Iq1* and electrical-potential-difference command value Vc* of a capacitor 50 passed on d shaft and q shaft of a motor generator MG 1 based on the generated torque command value TR11. Furthermore, control CPU 184 receives angle-of-rotation thetas from the electrical potential difference Vc and resolver 139 from the motor current 11 and MCRT 12 and a voltage sensor 51 from current sensors 12 and 13, and generates a signal 1 and PWMI 2 by the approach mentioned above based on the motor current 11 and MCRT 12, electrical potential difference Vc and angle-of-rotation thetas which were received, and calculated current command value Id1*, Iq1* and electrical-potential-difference command value Vc*. And control CPU 184 outputs the generated signal 1 and PWMI 2 to an inverter 181,182, respectively. Moreover, control CPU 184 generates the signal SE of H level, and outputs it to relay 40.

[0110]
When it does so, DC power supply 30 are connected at the neutral points M1 and M2, NPN transistors Q1-Q6 of an inverter 181 are turned on / turned off by the signal PWMI1, and NPN transistors Q7-Q12 of an inverter 182 are turned on / turned off by the signal PWMI2. And an inverter 181,182 changes the direct current voltage from a capacitor 50 into alternating voltage based on a signal 1 and PWMI 2, respectively, and impresses it to the three-phase-circuit coils 10 and 11 while it charges a capacitor 50 so that the pressure up of the electrical potential difference Vb outputted from DC power supply 30 may be carried out and the electrical potential difference Vc of the both ends of a capacitor 50 may become electrical-potential-difference command value Vc*.

[0111]
Thereby, the torque which drives a motor generator MG 1 so that the torque specified with the torque command value TR11 may be outputted, and a motor generator MG 1 outputs is transmitted to a crankshaft 156 through the Sun Geer shaft 125, a planetary gear 120, and the carrier shaft 127. And a crankshaft 156 rotates at an engine speed MRN1, and an engine 150 starts. Thereby, actuation of the power output unit 100 at the time of engine starting of a hybrid car is completed.

[0112]
Next, actuation of the power output unit 100 at the time of start of a hybrid car is explained. If a series of actuation is started, control CPU 184 will receive a start signal from Exterior ECU. And control CPU 184 generates the torque command value TR21 (a kind of the torque command value TR2) and the motor engine speed MRN2 for using a motor generator MG 2 for start according to a start signal, and calculates current command value Id2* passed on d shaft and q shaft of a motor generator MG 2 based on the generated torque command value TR21, and Iq2*.

[0113]
Moreover, control CPU 184 generates the torque command value TR12 (a kind of the torque command value TR1) and the motor rotational frequency MRN1 for operating a motor generator MG 1 as a generator on the turning effort of the engine 150 after starting. Current command value Id1*, and Iq1* and electrical-potential-difference command value Vc* of a capacitor 50 passed on d shaft and q shaft of a motor generator MG 1 based on the generated torque command value TR12 are calculated.

[0114]
And control CPU 184 calculates the power Pm of a motor (motor generator MG 2) at the torque command value TR21 and the motor engine speed MRN2, and calculates the power Pg of a generator (motor generator MG 1) at the torque command value TR12 and the motor engine speed MRN1. Sum Pm+Pg of the power Pm of a motor and the power Pg of a generator judges whether it is zero, and control CPU 184 judges whether the relay 40 is turned on, when sum Pm+Pg is not zero. Since the relay 40 is turned on at the time of starting of an engine 150, it calculates the potential difference V012 for lowering the pressure of the direct current voltage of a capacitor 50, and charging DC power supply 30, generating control CPU 184 with the three-phase-circuit coils 10 and 11 based on calculated current command value Id1*, Iq1* and electrical-potential-difference command value Vc*, and the electrical potential difference Vc received from the voltage sensor 51. And the control CPU 184 On the electrical potential differences Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 impressed to each phase of the three-phase-circuit coils 10 and 11 calculated based on current command value Id1*, Iq1*, and the motor current 11 and MCRT 12 from current sensors 12 and 13 and angle-of-rotation thetas from a resolver 139 The already calculated potential difference V012 is added, PWMC 1 and 2 is generated, and it outputs to an inverter 181,182, respectively.

[0115]
Moreover, control CPU 184 receives the motor current MCRT2 from a current sensor 14, and angle-of-rotation thetar from a resolver 149, based on the motor current MCRT2 and angle-of-rotation thetar which were received, and already calculated current command value Id2* and Iq2*, by the approach mentioned above, generates a signal PWMI3 and outputs it to an inverter 183.
[0116]
 If it does so, an inverter 181,182 will lower the pressure of the direct current voltage from a capacitor 50, and will charge DC power supply 30 while changing into direct current voltage the alternating voltage generated with the three-phase-circuit coils 10 and 11 according to the signal 1 and PWMC 2, respectively and charging a capacitor 50. Moreover, according to a signal PWMI3, an inverter 183 changes the direct current voltage from a capacitor 50 into alternating voltage, and drives a motor generator MG 2. And a motor generator MG 2 generates the torque specified with the torque command value TR21, transmits the generated torque to the power transfer gear 111 through the ring gear shaft 126, a planetary gear 120, the power fetch gear 128, and a chain belt 129, and drives a driving wheel, and a hybrid car departs from it.
[0117]
In this case, in a motor generator MG 1, although pressure-lowering actuation is performed, since a motor generator MG 1 does not drive a driving wheel, the start engine performance of a hybrid car does not fall.
[0118]
On the other hand, when sum Pm+Pg of the power Pm of a motor and the power Pg of a generator is zero, the current BCRT from a current sensor 31 judges further whether control CPU 184 is zero, and when Current BCRT is not zero, actuation in case sum Pm+Pg mentioned above is not zero is performed. And when the current BCRT from a current sensor 31 is zero, control CPU 184 judges whether the relay 40 is turned off. In this case, since the relay 40 has been turned on at the time of starting of an engine 150, control CPU 184 generates the signal SE of L level, and outputs it to relay 40. Thereby, relay 40 is turned off and DC power supply 30 are separated from the neutral points M1 and M2.
[0119]
And control CPU 184 sets the potential difference V012 of the neutral point M1 and the neutral point M2 as zero, generates a signal 1 and PWMC 2 based on current command value Id1*, Iq1*, and the motor current 11 and MCRT 12 from current sensors 12 and 13 and angle-of-rotation thetas from a resolver 139 that were already calculated, and outputs it to an inverter 181,182, respectively.
[0120]
Moreover, control CPU 184 receives the motor current MCRT2 from a current sensor 14, and angle-of-rotation thetar from a resolver 149, based on the motor current MCRT2 and angle-of-rotation thetar which were received, and already calculated current command value Id2* and Iq2*, by the approach mentioned above, generates a signal PWMI3 and outputs it to an inverter 183.
[0121]
If it does so, an inverter 181,182 will change into direct current voltage the alternating voltage generated with the three-phase-circuit coils 10 and 11 according to the signal 1 and PWMC 2, respectively, and will charge a capacitor 50. Moreover, according to a signal PWMI3, an inverter 183 changes the direct current voltage from a capacitor 50 into alternating voltage, and drives a motor generator MG 2. And a motor generator MG 2 generates the torque specified with the torque command value TR21, transmits the generated torque to the power transfer gear 111 through the ring gear shaft 126, a planetary gear 120, the power fetch gear 128, and a chain belt 129, and drives a driving wheel, and a hybrid car departs from it.
[0122]
In this case, since DC power supply 30 are separated from the neutral points M1 and M2, the generating efficiency of a motor generator MG 1 improves, and a motor generator MG 2 operates in the large range in response to the generated output from the motor generator MG 1 whose generating efficiency improved. Consequently, a hybrid car departs smoothly.
[0123]
Thereby, actuation of the power output unit 100 at the time of start of a hybrid car is completed.
[0124]
Next, the actuation in the power output unit 100 in case a hybrid car is in light load transit mode is explained. If a series of actuation is started, control CPU 184 will receive the signal which shows light load transit mode from Exterior ECU. Control CPU 184 generates the torque command value TR22 (a kind of the torque command value TR2) and the motor engine speed MRN2 for driving the front wheel of a hybrid car by the motor generator MG 2 according to the signal which shows light load transit mode, and calculates current command value Id2* passed on d shaft and q shaft of a motor generator MG 2 based on the

generated torque command value TR22, and Iq2*. Moreover, control CPU 184 receives the motor current MCRT2 from a current sensor 14, and angle-of-rotation thetar from a resolver 149. And based on the motor current MCRT2 and angle-of-rotation thetar which were received, and calculated current command value Id2* and Iq2*, by the approach mentioned above, control CPU 184 generates a signal PWMI3, and outputs it to an inverter 183.

[0125]

An inverter 183 changes the direct current voltage from a capacitor 50 into alternating voltage according to a signal PWMI3, and drives a motor generator MG 2. And a motor generator MG 2 generates the torque specified with the torque command value TR22, the generated torque is transmitted to the power transfer gear 111 through the ring gear shaft 126, a planetary gear 120, the power fetch gear 128, and a chain belt 129, a driving wheel is driven, and a hybrid car performs light load transit. Thereby, actuation of the power output unit 100 in case a hybrid car is in light load transit mode is completed.

[0126]

Next, actuation of the power output unit 100 in case a hybrid car is in medium-speed low loading transit mode is explained. Actuation of the power output unit 100 in this case is the same as actuation of the power output unit 100 at the time of starting of the engine 150 of the hybrid car mentioned above.

[0127]

Next, actuation of the power output unit 100 in case a hybrid car is in acceleration and sudden acceleration mode is explained. If a series of actuation is started, control CPU 184 will receive the signal which shows acceleration and sudden acceleration mode from Exterior ECU. And control CPU 184 generates the torque command value TR23 (a kind of the torque command value TR2) and the motor engine speed MRN2 for using a motor generator MG 2 for acceleration and sudden acceleration according to the signal which shows acceleration and sudden acceleration mode, and calculates current command value Id2* passed based on the generated torque command value TR23 on d shaft and q shaft of a motor generator MG 2, and Iq2*.

[0128]

Moreover, control CPU 184 generates the torque command value TR13 (a kind of the torque command value TR1) and the motor engine speed MRN1 for operating a motor generator MG 1 as a generator on the turning effort of an engine 150, and calculates current command value Id1*, and Iq1* and electrical-potential-difference command value Vc* of a capacitor 50 passed based on the generated torque command value TR13 on d shaft and q shaft of a motor generator MG 1.

[0129]

And control CPU 184 calculates the power Pm of a motor (motor generator MG 2) at the torque command value TR23 and the motor engine speed MRN2, and calculates the power Pg of a generator (motor generator MG 1) at the torque command value TR13 and the motor engine speed MRN1. Sum Pm+Pg of the power Pm of a motor and the power Pg of a generator judges whether it is zero, and control CPU 184 judges whether the relay 40 is turned on, when sum Pm+Pg is not zero. And if the relay 40 is not turned on, control CPU 184 generates the signal SE of H level, and outputs it to relay 40. Thereby, DC power supply 30 are connected at the neutral points M1 and M2.

[0130]

Then, control CPU 184 calculates the potential difference V012 for lowering the pressure of the direct current voltage of a capacitor 50, and charging DC power supply 30 based on calculated current command value Id1*, Iq1* and electrical-potential-difference command value Vc*, and the electrical potential difference Vc received from the voltage sensor 51, generating electricity with the three-phase-circuit coils 10 and 11. And the control CPU 184 On the electrical potential differences Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 impressed to each phase of the three-phase-circuit coils 10 and 11 calculated based on current command value Id1*, Iq1*, and the motor current 11 and MCRT 12 from current sensors 12 and 13 and angle-of-rotation thetas from a resolver 139 The already calculated potential difference V012 is added, PWMC 1 and 2 is generated, and it outputs to an inverter 181,182, respectively.

[0131]

Moreover, control CPU 184 receives the motor current MCRT2 from a current sensor 14, and angle-of-rotation thetar from a resolver 149, based on the motor current MCRT2 and angle-of-rotation thetar which were received, and already calculated current command value Id2* and Iq2*, by the approach mentioned above, generates a signal PWMI3 and outputs it to an inverter 183.

[0132]

If it does so, an inverter 181,182 will lower the pressure of the direct current voltage from a capacitor 50, and will charge DC power supply 30 while changing into direct current voltage the alternating voltage

generated with the three-phase-circuit coils 10 and 11 according to the signal 1 and PWMC 2, respectively and charging a capacitor 50. Moreover, according to a signal PWMI3, an inverter 183 changes the direct current voltage from a capacitor 50 into alternating voltage, and drives a motor generator MG 2. And a motor generator MG 2 generates the torque specified with the torque command value TR23, transmits the generated torque to the power transfer gear 111 through the ring gear shaft 126, a planetary gear 120, the power fetch gear 128, and a chain belt 129, drives a driving wheel, and accelerates and accelerates [sudden] a hybrid car.

[0133]

In this case, in a motor generator MG 1, although pressure-lowering actuation is performed, since a motor generator MG 1 does not drive a driving wheel, the start engine performance of a hybrid car does not fall.

[0134]

On the other hand, when sum Pm+Pg of the power Pm of a motor and the power Pg of a generator is zero, the current BCRT from a current sensor 31 judges further whether control CPU 184 is zero, and when Current BCRT is not zero, actuation in case sum Pm+Pg mentioned above is not zero is performed. And when the current BCRT from a current sensor 31 is zero, control CPU 184 judges whether the relay 40 is turned off. And when the relay 40 is not turned off, control CPU 184 generates the signal SE of L level, and outputs it to relay 40. Thereby, relay 40 is turned off and DC power supply 30 are separated from the neutral points M1 and M2.

[0135]

Then, control CPU 184 sets the potential difference V012 of the neutral point M1 and the neutral point M2 as zero, generates a signal 1 and PWMC 2 based on current command value Id1*, Iq1*, and the motor current 11 and MCRT 12 from current sensors 12 and 13 and angle-of-rotation thetas from a resolver 139 that were already calculated, and outputs it to an inverter 181,182, respectively.

[0136]

Moreover, control CPU 184 receives the motor current MCRT2 from a current sensor 14, and angle-of-rotation thetar from a resolver 149, based on the motor current MCRT2 and angle-of-rotation thetar which were received, and already calculated current command value Id2* and Iq2*, by the approach mentioned above, generates a signal PWMI3 and outputs it to an inverter 183.

[0137]

If it does so, an inverter 181,182 will change into direct current voltage the alternating voltage generated with the three-phase-circuit coils 10 and 11 according to the signal 1 and PWMC 2, respectively, and will charge a capacitor 50. Moreover, according to a signal PWMI3, an inverter 183 changes the direct current voltage from a capacitor 50 into alternating voltage, and drives a motor generator MG 2. And a motor generator MG 2 generates the torque specified with the torque command value TR23, transmits the generated torque to the power transfer gear 111 through the ring gear shaft 126, a planetary gear 120, the power fetch gear 128, and a chain belt 129, drives a driving wheel, and accelerates and accelerates [sudden] a hybrid car.

[0138]

In this case, since DC power supply 30 are separated from the neutral points M1 and M2, the generating efficiency of a motor generator MG 1 improves, and a motor generator MG 2 operates in the large range in response to the generated output from the motor generator MG 1 whose generating efficiency improved. Consequently, a hybrid car is accelerated and sudden accelerated smoothly. Thereby, actuation of the power output unit 100 at the time of acceleration and sudden acceleration of a hybrid car is completed.

[0139]

Next, actuation of the power output unit 100 in case a hybrid car is in low mu way transit mode is explained. If a series of actuation is started, control CPU 184 will receive the signal which shows low mu way transit mode from Exterior ECU. Control CPU 184 generates the torque command value TR24 and the motor engine speed MRN2 for driving a motor generator MG 2 in regeneration mode according to the signal which shows low mu way transit mode, and calculates current command value Id2* passed on d shaft and q shaft of a motor generator MG 2 based on the generated torque command value TR24, and Iq2*.

[0140]

And control CPU 184 generates a signal PWMC3 based on the motor current MCRT2 from a current sensor 14, angle-of-rotation thetar from a resolver 149, and already calculated current command value Id2* and Iq2*, and outputs it to an inverter 183.

[0141]

If it does so, an inverter 183 will change into direct current voltage the alternating voltage which the motor

generator MG 2 generated based on a signal PWMC3, and will charge a capacitor 50. Thereby, actuation of the power output unit 100 at the time of low mu way transit of a hybrid car is completed.

[0142]

Finally, actuation of the power output unit 100 in case a hybrid car is in moderation / braking mode is explained. In this case, since transit energy is collected as electrical energy, a motor generator MG 2 is driven in regeneration mode. Therefore, actuation of the power output unit 100 in this case is the same as actuation of the power output unit 100 at the time of low mu way transit.

[0143]

According to the gestalt of this operation, a power output unit A motor generator MG 1 DC power supply during the neutral point of a motor generator MG 2, DC power supply, and two three-phase-circuit coils of a motor generator MG 1 Connection / un-connected relay, When driving a motor generator MG 2 with the power generated by the motor generator MG 1, Since it has the control CPU which controls a relay so that DC power supply may be separated from the neutral point of two three-phase-circuit coils of a motor generator MG 1, the generating efficiency of a motor generator MG 1 can be raised, and a motor generator MG 2 can be operated in the large range. Moreover, since Control CPU drives a motor generator MG 1 so that pressure-up actuation or pressure-lowering actuation may be carried out, effectiveness of the motor generator MG 2 which drives the driving wheel of a hybrid car is made as for it to max.

[0144]

It should be thought that the gestalt of the operation indicated this time is [no] instantiation at points, and restrictive. The range of this invention is shown by the above-mentioned not explanation but claim of the gestalt of operation, and it is meant that all modification in a claim, equal semantics, and within the limits is included.

[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram of the power output unit by the gestalt of implementation of this invention.

[Drawing 2] It is the enlarged drawing of the motor combined with the planetary gear and it which show drawing 1 .

[Drawing 3] It is the electrical diagram of the principal part of the power output unit shown in drawing 1 .

[Drawing 4] It is the plane configuration Fig. of two three-phase-circuit coils shown in drawing 3 .

[Drawing 5] It is a circuit diagram for explaining to the leakage inductance of U phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 paying attention to the flow of the current in the condition that the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 is smaller than the electrical potential difference Vb of DC power supply 30.

[Drawing 6] It is a circuit diagram for explaining to the leakage inductance of U phase of the three-phase-circuit coils 10 and 11 of the 2Y motor MG 1 paying attention to the flow of the current in the condition that the potential difference V012 of the neutral point M1 of the three-phase-circuit coil 10 and the neutral point M2 of the three-phase-circuit coil 11 is larger than the electrical potential difference Vb of DC power supply 30.

[Drawing 7] It is the wave form chart showing the potentials Vu1, Vv1, and Vw1 of the three-phase-circuit coil 10 when operating it so that the difference of the potential V01 of the neutral point M1 of the three-phase-circuit coil 10 and the potential V02 of the neutral point M2 of the three-phase-circuit coil 11 may be in agreement with the electrical potential difference Vb of DC power supply 30, and the potentials Vu2, Vv2, and Vw2 of the three-phase-circuit coil 11.

[Drawing 8] It is a functional block diagram for explaining the function of a part of control CPU shown in drawing 3 .

[Drawing 9] It is a flow chart for explaining actuation of the power output unit by this invention.

[Drawing 10] It is the outline block diagram of the conventional power output unit.

[Description of Notations]

1 Power-Source Rhine, 2 10 Earth Line, 11,134,144,311,312 Three-Phase-Circuit Coil, 12- 14 and 31 A current sensor, and 15, 18 and 21 U phase arm -- 16, 19, 22 V phase arm, 17, 20, 23 W phase arm, 30,320 DC power supply, 40 A relay, 50,350 Capacitor, 51 A voltage sensor, 100,300 A power output unit, 111 Power transfer gear, 112 A driving shaft, 114 A differential gear, 120 Planetary gear, 121 Sun Geer, 122 A ring gear, 123 Planetary pinion gear, 124 A planetary carrier, 125 The Sun Geer shaft, 126 Ring gear shaft, 127 A carrier shaft, 128 A power fetch gear, 129 Chain belt, 132,142 Rota, 133,143 A stator, 135,145 Permanent magnet, 139,149,159 A resolver, 156 Crankshaft, 157 A damper, 164a Accelerator pedal position

sensor, 165a A brake-pedal position sensor, 180 Control unit, 181-183,330,340 An inverter, 184 control CPU 185 A shift position sensor, 301 A positive-electrode bus-bar, a 302 negative-electrode bus-bar, 310 A double coil motor, 1841 1842 A current transducer, 1852 Subtractor, 1843, 1853, 1855 1844 The PI control section, 1846 Adder, 1845 A transducer, 1847 PWM operation part, 1849 Rotational-speed operation part, 1850 Speed-electromotive-force prediction operation part, 1854 An adder subtracter, MG1, MG2 A motor generator, Q1-Q18 An NPN transistor, D1-D18 Diode, M1, M2 Neutral point.

[Translation done.]

* NOTICES *

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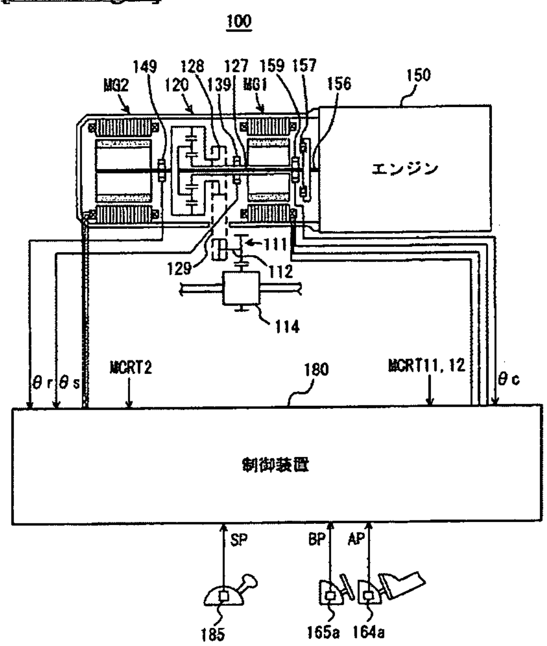
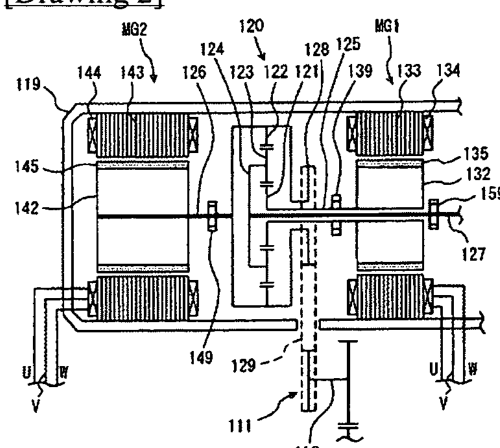
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

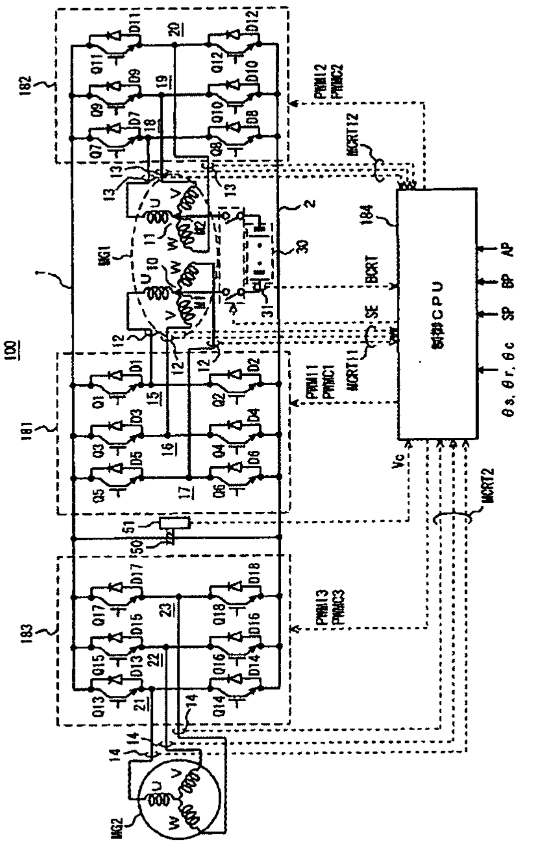
[Drawing 1]



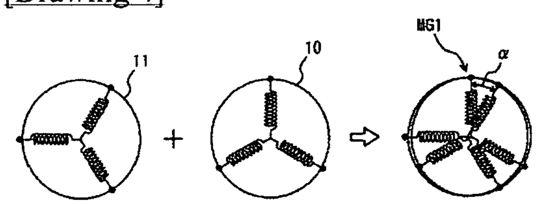
[Drawing 2]



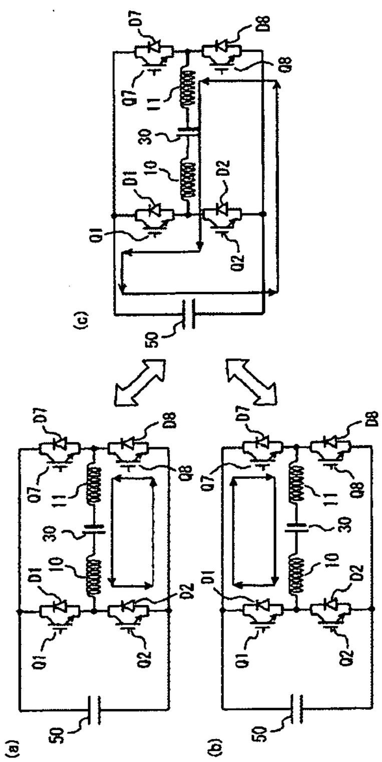
[Drawing 3]



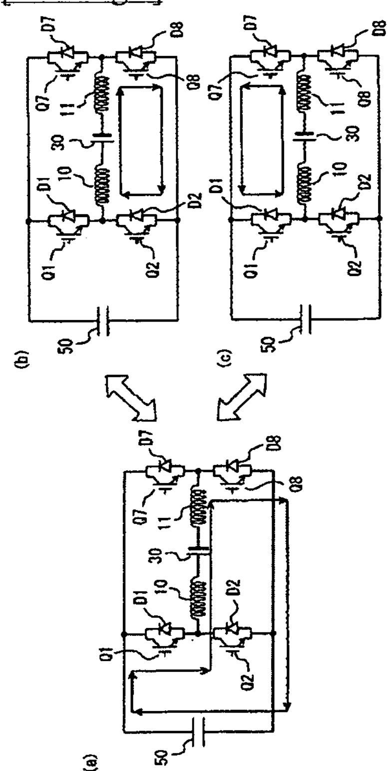
[Drawing 4]



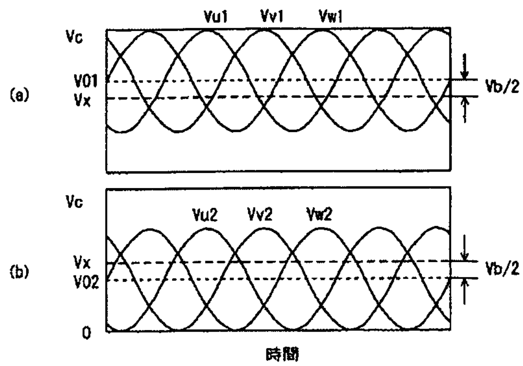
[Drawing 5]



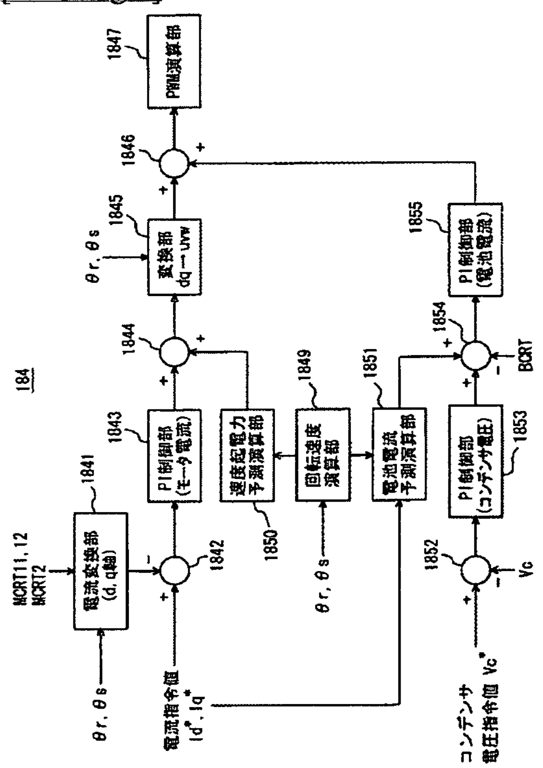
[Drawing 6]



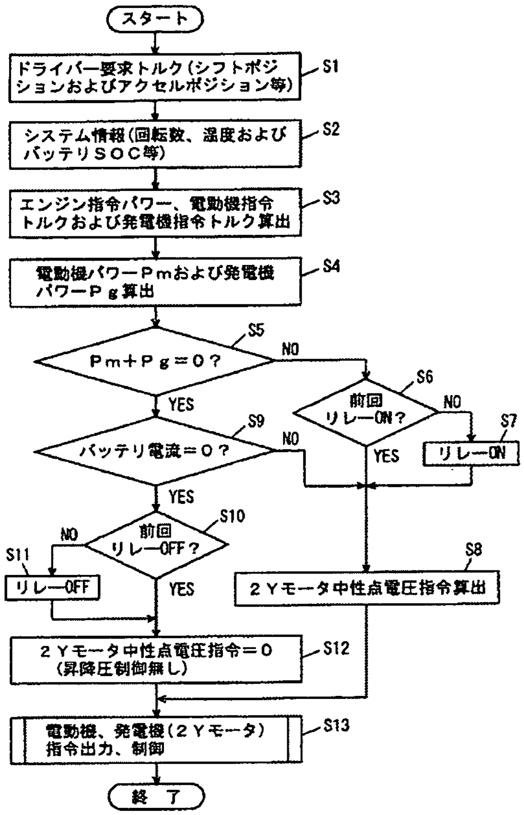
[Drawing 7]



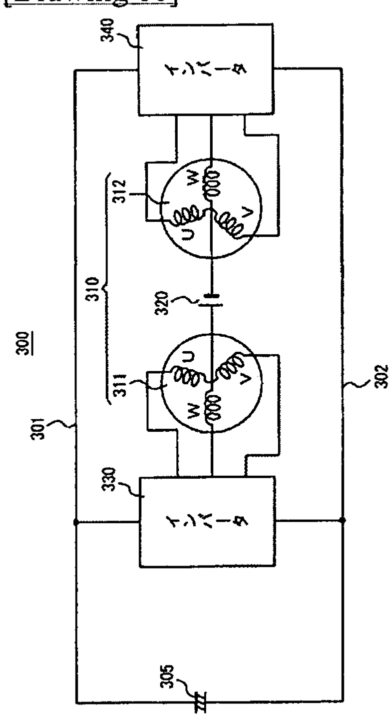
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]